

Presentation & Management of Common Thoracic Diseases



Objectives

- Identify the symptoms of common thoracic and lung disease
- Discuss the physical examination
- Describe the surgical Anatomy, Blood Supply, Airway Anatomy.
- Recognize the congenital Diseases of the lungs.
- Discuss the assessment of the patient, full history and examination.
- Describe bronchogenic Carcinoma: Primary: SCLC, NSCLC.
- Discuss the assessment for pulmonary resection
- Discuss metastatic Disease
- Discuss other lung tumors
- Describe the Mediastinum
- Recognize pneumothorax (Types, Presentation, and management)
- Discuss chest trauma
- Discuss the pleuro-pulmonary infections like:
 - Lung abscess, Bronchiectasis, Tuberculosis, Aspergilloma of the Lung, Hydatid cyst and Empyema
- Recognize the chest wall deformities, like Pectus
- Recognize the chest tube indications

Colour Index

- Main Text
- Males slides
- Females slides
- Doctor notes
- Textbook
- Important
- ★ Golden notes
- Extra

Anatomy of the lung:

The lung

Embryology

Bronchial system

Alveolar system

Anatomy

Lobes

Segments

Fissures

Blood supply

➤ Bronchopulmonary segments:

Right Lung

- Has 3 lobes:
 - Upper lobe, divided into 3 segments [Apical (S1), Posterior (S2), Anterior (S3)].
 - Middle lobe, divided into 2 segments [Lateral (S4), Medial (S5)] (present in the left lung as Lingular division of upper lobe).
 - Lower lobe, divided into 5 segments [Superior or Apical lower (S6), Medial basal (S7), Anterior basal (S8), Lateral basal (S9) Posterior basal (S10)].
- Has 2 fissures:
 - oblique fissure: divides the lower lobe from other lobes.
 - transverse (horizontal) fissure: divides the upper and middle lobes.



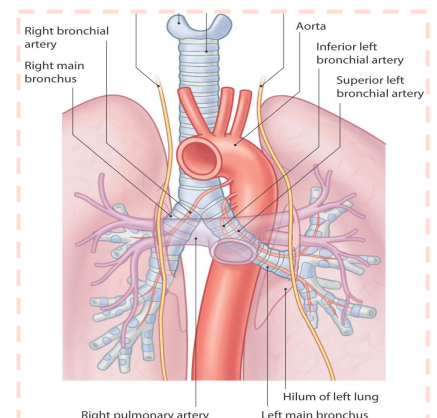
Left Lung

- Has 2 lobes:
 - Upper lobe, divided into [Apico-posterior (S1+S2), Anterior (S3) segments] and has Lingular division [Superior (S4), inferior (S5) segments].
 - Lower lobe, divided into Superior or Apical lower (S6), Anterior-medial basal (S7+8), Lateral basal (S9) and Posterior basal (S10) segments], has no medial segment due to the position of the heart.
- Has oblique fissure which divides the left lung.

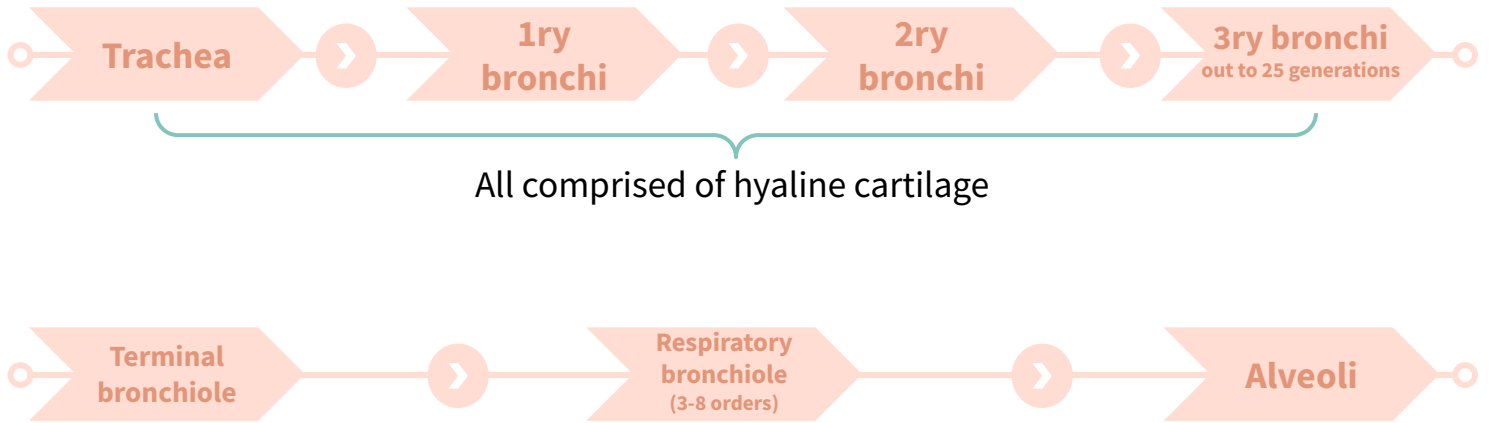


➤ Blood supply:

- Lungs do not receive any vascular supply from the pulmonary vessels (pulmonary artery or veins) As they are part of the pulmonary circulation.
- Blood delivered to lung tissue via the bronchial arteries.
- Vessels evolve from intercostal arteries or directly from aortic arch.
- Travel along the bronchial tree.

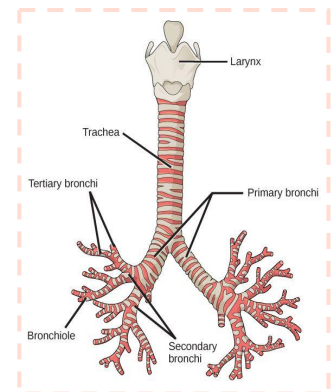


Airways:



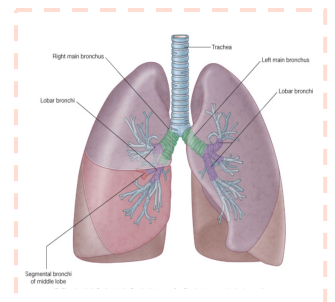
Trachea:

- Begins where larynx ends (about C6) and bifurcates to right and left bronchi (at the site of primary carina).
- 10 cm long, half in neck, half in mediastinum.
- 20 U-Shaped rings of hyaline cartilage, keeps lumen intact but not as brittle as bone.
- Lined with epithelium and cilia which work to keep foreign bodies/irritants away from lungs.
- Anterior & lateral walls are formed of cartilage while the posterior wall is membranous with smooth muscles and it's in contact with the esophagus. If there's increased pressure necrosis of the posterior wall of the trachea (iatrogenic injury, blunt chest or neck trauma, prolonged mechanical ventilation via endotracheal or tracheostomy tube, and excessive tube cuff pressure in patients ventilated for lung disease) it may lead to tracheoesophageal fistula (emergency). Bronchiectasis and immotile cilia syndrome may lead to impaired cilia motility.



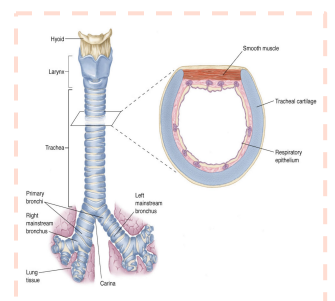
Primary -main- bronchi:

- The right main bronchus is shorter, wider and vertical (more in continuation with the trachea) while the left main bronchus is longer, narrower and more angular.
- So when **foreign bodies get aspirated**, it will most likely go to the **right main bronchus** > inferior lobar bronchus > lower lobe of right lung (this is due to the structural differences).



Bronchioles:

- First level of airway surrounded by smooth muscle; therefore can change diameter as in bronchoconstriction and bronchodilation.



Diseases of the lung:

1- Congenital Lung Diseases:

1

Agenesis

2

Hypoplasia

3

Cystic Adenomatoid Malformation

4

Pulmonary Sequestration

5

Lobar Emphysema

6

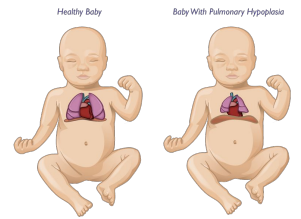
Bronchogenic Cyst

Agenesis

- No development / complete absence of the lungs (could be unilateral or bilateral).

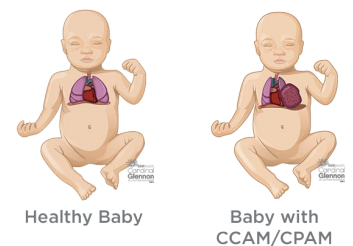
Hypoplasia

- Incomplete development of the lungs (the patient may present with small non functioning lung).



Cystic Adenomatoid Malformation

- Overgrowth of abnormal lung tissue that does not function properly and may form fluid-filled cysts.
- Pediatric patients usually present with pneumothorax, repetitive chest infections, fever and malformation & chest abnormality on CXR and CT-scan.
- Surgery is needed to remove this part of the lung.



Lobar Emphysema

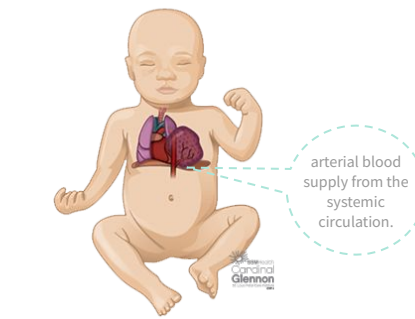
- It can affect children and newborns, it happens when the entire lobe (usually the right upper lobe) is replaced with a big cyst or emphysematous bullae
- The newborn will not be able to breath and need to be put on +ve pressure mechanical ventilation.
- The longer they're put on a ventilator the more likely that the emphysematous bullae enlarges and starts to compress other parts of the lung "like a balloon". So to relieve the patient from the ventilator, we have to do lobectomy (removal of the entire lobe surgically) and then inflate the lung again.

Pulmonary Sequestration

- Pulmonary sequestration is more commonly seen in pedia population however it can be present in adults.
- It's a nonfunctional mass of normal lung tissue that lacks normal communication with the airways. Part of the lung loses its connection from the major bronchial tree (appears as sequestered mass) and any secretions or inflammatory processes may precipitate chest infections.
- It can be extra- or intralobar¹ and it's usually located in the left lower lobe.
- On CXR or CT-scan: a mass is found (usually in the left lower lobe).
- patients present with repetitive infections.
- It is characterized by receiving its own arterial blood supply from the systemic circulation (especially thoracic aorta, it could be two or three major arteries). So the surgeon should identify the blood supply (in case of resection) by CT scan with contrast to locate the blood supply (these vessels could be above, below, or directly on the diaphragm) to prevent massive bleeding. We have to control the abnormal systemic blood supply coming from a major Aorta by carefully tying the blood vessel first during the surgical procedure.



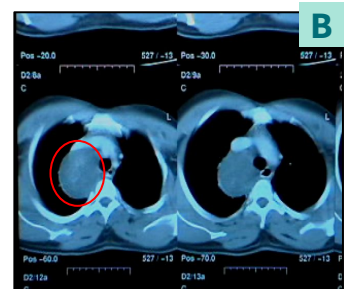
Healthy Baby



Baby with Bronchopulmonary Sequestration

Bronchogenic Cyst²

- It's a benign cysts with malignant position, because it can compress vital organs (e.g. trachea, esophagus, vessels) and it's filled with fluid and supportive debris which makes it prone to infections.
- Location: right paratracheal (most common) and subcarinal.
- Patient can present with dysphagia and stridor³.
- Complications: infections, hemorrhage and transformation to malignant adenocarcinoma if left untreated for a long time.
- Treatment: surgical resection of the cyst by thoracoscopy. Or if it's adherent to SVC or the heart (tricky situations), a thoracotomy is performed.
- **Picture A:** CXR showing abnormal cyst in the middle posterior mediastinum which is compressing the esophagus and trachea.
- **Picture B:** CT scan showing a big cyst posterior to SVC and near to trachea, if it increases in size, it will compress on trachea or esophagus, could even lead to compression of SVC and massive bleeding.



1. **Intralobar:** Sequestration in normal lung tissue covered by normal visceral pleura; usually found in adults.

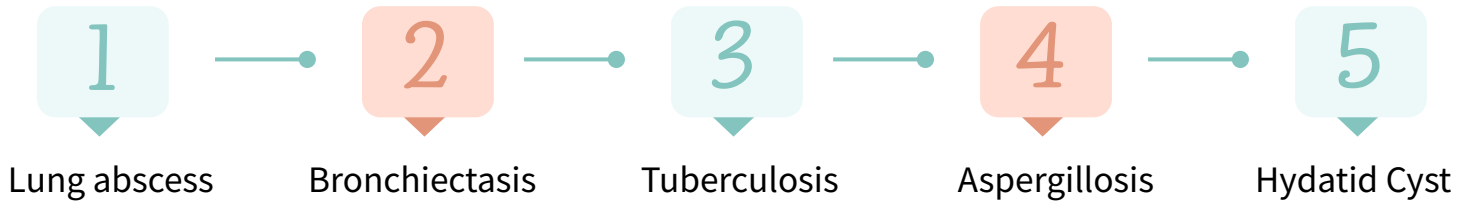
Extralobar: Sequestration not in normal lung covered by its own pleura; usually found in children.

2. Bronchus and cartilaginous components are benign in nature.

3. Stridor is a noisy or high-pitched wheezing sound with breathing. It is a sign that the upper airway is partially blocked.

Diseases of the lung:

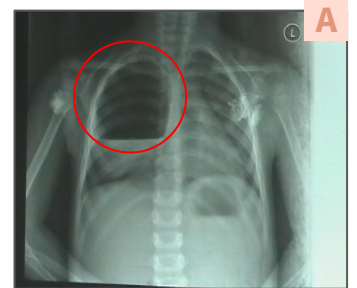
2- Infectious Lung Disease:



Lung Abscess



- Immunocompromised (Diabetic, HIV, etc), complication of pneumonia, bronchial obstruction (by tumor or inhaled foreign bodies especially in children) bacteremia, and septic emboli.



Picture A: showing air-fluid level abscess in the right upper lobe of the lung (Air-fluid level means it's made up of these two components).



- Copious production of foul smelling sputum
- Productive Cough +/- hemoptysis
- Septic, toxic, high fever & chills
- Severe chest pain and difficulty breathing



- CXR
- CT



Concerted management:

- Antibiotics
- Drainage by pigtail catheters:
 - Internal (bronchoscope).
 - External (Percutaneous Tube Drainage).



- Pulmonary resection
- Type of Resection:
 - Lobectomy
 - Segmentectomy
 - Pneumonectomy
- **Resection Indications:**
 - Failure of medical RX
 - Giant abscess (>5cm)
 - Hemorrhage
 - Inability to rule out carcinoma due to old age, patient being a heavy smoker or the abscess being large with thick wall.
 - Which carcinoma causes abscess? Squamous
 - Rupture with resulting empyema

★ Bronchiectasis¹

→ It is a bronchial dilatation



- Congenital e.g. Immotile cilia syndrome, Mucoviscidosis (cystic fibrosis).
- Infection e.g. whooping cough, untreated pneumonia.
- Obstruction e.g. Foreign body when a foreign body stays for 6 months or longer (year).



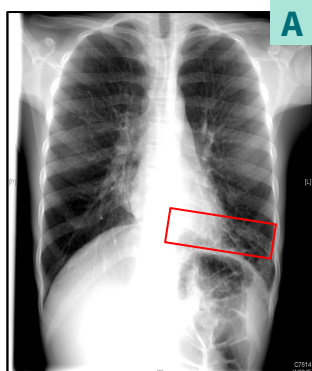
- **Types:** cystic or cylindrical (cystic type is surgically corrected while Cylindrical type e.g. Cystic fibrosis, immotile cilia syndrome, are not surgically correctable)
- Productive morning cough due to collection of secretions during sleep.
- Dyspnea
- Haemoptysis (50%)
- Clubbing can be due to; pulmonary, congenital cardiac, GI disorders or idiopathic.



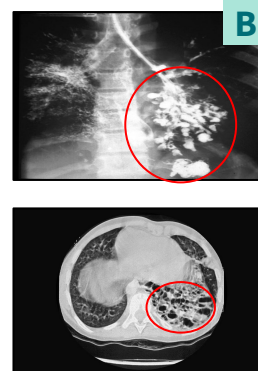
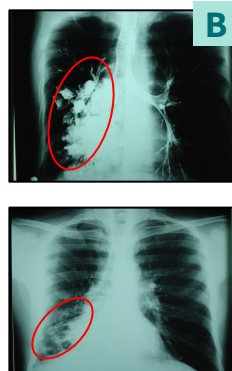
- CXR
- CT Confirmatory
- Bronchogram rarely used
- Bronchoscopy to detect obstruction



- **Medical:**
 - Medical Rx is usually for bilateral conditions (to avoid removing two lungs).
 - Antibiotics, supportive, Postural drainage.
 - resolve most cases
- **Surgical:**
 - Failure of medical RX
 - Patient with localized disease
 - Cystic type (cystic type is usually localized & non perfused.)
 - Non Perfused (perfusion is measured by Ventilation-perfusion scanning.)



Picture A: CXR showing an area of cystic changes affecting the lower lobe of the left lung.



Picture B: Bronchogram (using catheter and contrast) shows cystic formation, destroyed bronchi filled with pus.

1. Dilatation of bronchi and bronchioles can follow childhood infections, e.g., measles or pertussis. The stagnant pools of secretions that collect are subject to continued infection, resulting in episodes of acute pulmonary infection or pneumonia and, more rarely, in haemoptysis.

Tuberculosis



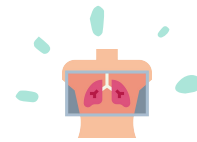
Epidemiology

- 30,000 new cases occur annually in U.S.A



Causes

- Pulmonary
- Extra-pulmonary e.g. TB Emyema, TB Lymphadenitis



Investigation

- CXR
- CT
- Bronchoscopy



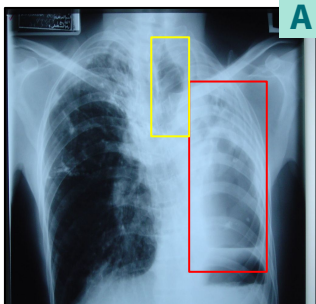
Treatment

- Medical:
 - 1st & 2nd lines of Anti-TB.



Surgery

- Surgical¹:
 - Failure of medical RX
 - Destroyed lobe or lung
 - Pulmonary haemorrhage
 - Persistent open cavity with +ve sputum
 - Persistent broncho-pulmonary fistula



A

Picture A: CXR showing full destruction of the left lung (red) and deviation of the trachea (yellow) to the left-towards the pathology- due to increased space (usually tracheal pull is due to; collapsing lung, fibrosis). And this patient was treated by left pneumonectomy.



B

Picture B: CT-scan showing right upper lobe destruction (red) with formation of fistula (yellow) between the lung and the pleural cavity & trachea.

1. Present indications for surgery in pulmonary tuberculosis also include the complications of pulmonary tuberculosis: pneumothorax, empyema, bronchopleural fistula, bronchiectasis, massive haemoptysis, lung abscess and aspergilloma in a tubercular cavity.

Aspergillosis



Causes

- *Aspergillus fumigatus*, *Asp. niger*



Mode of Transmission

- Inhalation of airborne conidia, contaminated water (while showering), and nosocomial infections. Especially in immunocompromised patients.



Forms

- 8 forms
- Allergic
- Saprophytic
- Invasive



Clinical Feature

- Aspergilloma (mycetoma) cavity ball-like in CT
- Hemoptysis (patients with preexisting disease like TB or immunocompromised) it starts very mild (a warning sign).
- Chronic productive cough



Investigation

- Skin test
- sputum
- biopsy (Invasive → LVA or open biopsy)
- CXR (radiolucent)
- CT characteristic; aspergilloma cavity with fungating core that eats the bronchus away, it bleeds once it reaches a bronchial artery.



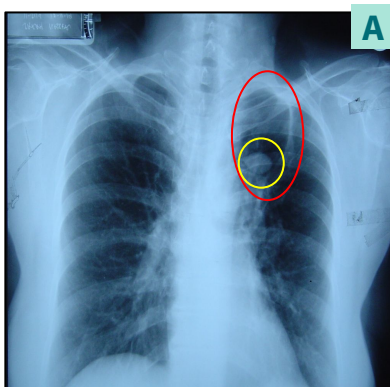
Treatment

- Medical:
 - Anti-fungal medications

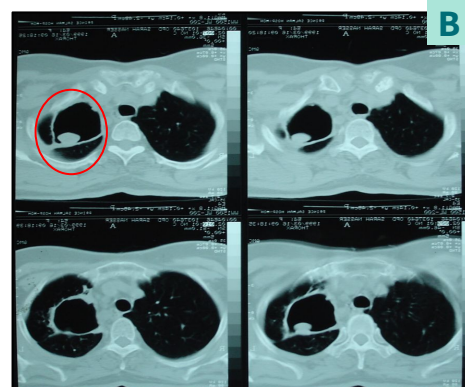


Surgery

- Surgical:
- Indication:
 - A significant aspergilloma & Haemoptysis.
- Type of resection:
 - Segmentectomy, Lobectomy, Pneumonectomy.



Picture A: CXR showing aspergilloma complex with cavity (red) and mycetoma (yellow) which is a mass-like fungus ball.



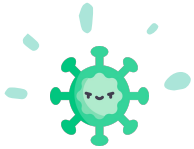
B

Hydatid Cyst



Causes

- Echinococcus granulosus



lifecycle

- E. granulosus is made of 4 segments.
- The lifecycle of E. granulosus involves dogs as a definitive host where the parasite reaches maturity and reproduce. Sheeps, serve as an intermediate host and transmit the parasite to humans when undercooked meat is eaten (especially the liver). The parasite will go to the bowel → lymphatics → portal system → portal veins → liver → venous system → lungs (Therefore any patient with hydatid cyst in the liver, needs screening of the lungs and vice versa) → pulmonary artery → heart → systemic circulation → and goes anywhere (e.g. brain, bone, pancreas).



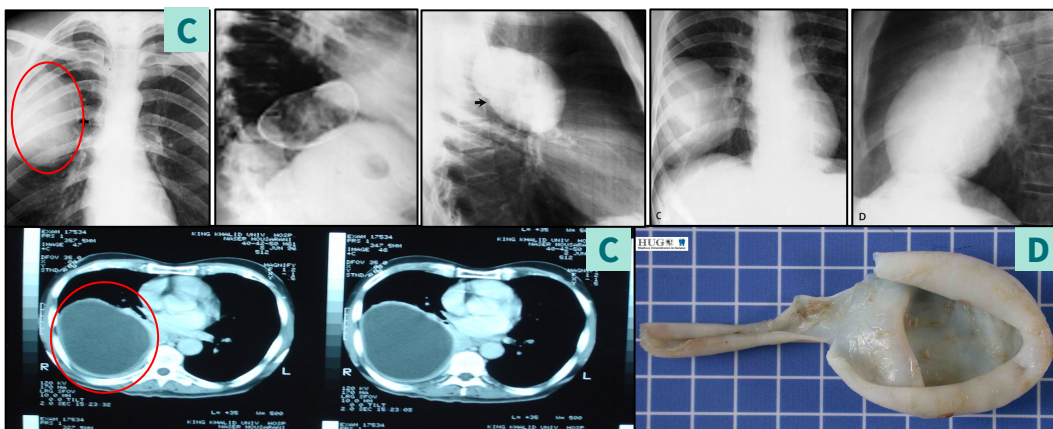
Investigation

- Skin test (Casoni's reaction) & CXR
- CT scan (a chronic cyst appears calcified, can be found incidentally or after complications)
- High echinococcus titers and other serologic tests



Treatment

- Surgery + inject hyperosmotic saline + albendazole (Needle aspiration is contraindicated)



Picture C: CXR and CT-scan both showing hydatid cyst which is filled with water and 3-5 millions embryos, if it's ruptured it can lead to anaphylactic shock thus needles are contraindicated. The cyst can be located anywhere else in the body but mostly common in the lung and liver.

Picture D: the cyst is made of three layers:

- 1st 'false layer' adventitia
- 2nd laminated membrane
- 3rd germinal layer (gives eggs)



3- Lung Tumors:

1

Benign



2

Malignant:

Primary or secondary

Almost all cancers metastasize to the lungs, thus biopsy is needed to establish the right diagnosis

A. Primary lung carcinoma

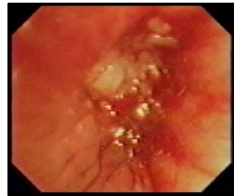
Incidence	More common in males.	
Risk Factors	<ul style="list-style-type: none"> ● Smoking (mainly) ● other: carcinogenic radiation, asbestos and nickel. 	
Pathology	NSCLC (Non-Small Cell Lung Carcinoma)	SCLC (Small Cell Lung Carcinoma)
	<ul style="list-style-type: none"> ● Adenocarcinoma ● Squamous cell carcinoma ● Large cell carcinoma → Surgery is possible 	<ul style="list-style-type: none"> → Systemic dissemination, surgery isn't possible. ★ CT is used for staging in SCLC.
Clinical Features ★	<ul style="list-style-type: none"> ● Asymptomatic ● Symptomatic <ul style="list-style-type: none"> ○ Lung (causing repetitive chest infections, cough, hemoptysis) ○ Surrounding structures: <ul style="list-style-type: none"> - Recurrent laryngeal nerve (causing paralysis of the vocal cords → hoarseness) - Esophagus (causing dysphagia) - C8, T1 nerve (causing severe pain in the brachial plexus) - Sympathetic (causing horner's syndrome: ptosis, miosis, and anhidrosis) - Pleura (causing severe pleuritic chest pain) - Superior Vena Cava (causing SVC obstruction syndrome) ○ Distal (paraneoplastic syndrome) results in hypersecretions of: <ul style="list-style-type: none"> - Parathyroid Like Hormone - Antidiuretic Like Hormone - Adrenocorticotrophic Like Hormone - Hypertrophic pulmonary osteoarthropathy (severe joint and bone pain, due to hormonal secretion which won't respond to medications) 	

- Primary lung cancers: arise within the bronchial epithelium and are hence termed bronchogenic carcinoma.
- Bronchogenic carcinoma is the leading cause of death because of malignancy in men and women. The far majority of cases are directly related to cigarette smoking; the occasional non- smoker who has lung cancer develops adenocarcinoma. The most common symptom at the time of diagnosis is cough (74%). Weight loss is seen in 68% of patients. Dyspnea is seen in 58% of patients. Hoarseness when seen indicates a unresectable bronchogenic carcinoma. The diagnosis of bronchogenic carcinoma can be made by sputum cytology, with the highest yield in patients with squamous cell carcinoma (>80%) because it is intraluminal and centrally located. Bronchoscopy is best for centrally located lesions (yield of 90%) and is helpful in staging. For the 10% of centrally located lesions not detected by bronchoscopy.
- Nodal spread occurs to the intra-lobar, hilar and mediastinal nodes, and thence to the scalene nodes. Metastases occur in bone, brain, liver, adrenals and lung. Local direct spread may involve the chest wall, vertebrae, trachea, oesophagus and great vessels.
- Secondary Lung Cancer: are the most common form of intrathoracic malignancy. A confirmatory diagnostic lung biopsy may be helpful for patients with no evident primary. A palliative pleurodesis in patients with associated pleural effusion can be achieved by instilling an irritant such as aluminium silicate powder (kaolin) into the pleural cavity.

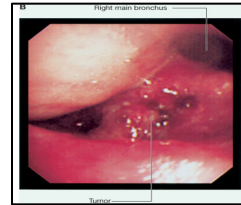
A. Primary lung carcinoma

Investigations

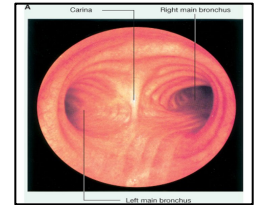
- CXR
- Bronchoscopy
- Trans-thoracic needle aspiration FNA, true cut biopsy
- CT scan with IV contrast → GOLDEN STANDARD
- MRI (in case of soft tissue invasion)



Lung cancer - upper lobe



Tumor



Bronchoscope

Staging

- TNM staging system

NEW INTERNATIONAL REVISED STAGE GROUPING

Stage 0	TIS
Stage IA	T1, NO, MO
Stage IB	T2, NO, MO
Stage IIA	T1, N1, MO
Stage IIB	T2, N1, MO
	T3, NO, MO
Stage IIIA	T1-3, N2, MO
	T3, N1, MO
Stage IIIB	T4, Any N, MO
	Any T, N3, MO
Stage IV	Any T, Any N, M1

Management

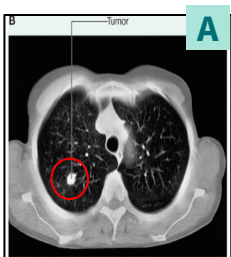
- Depends on:
 - Stage
 - Cell type
 - Patient physical fitness

NSCLC (Non-Small Cell Lung Carcinoma)

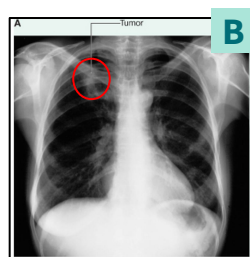
- In early stages:
 - Surgical
- In advanced stages:
 - Radiotherapy
 - Chemotherapy

SCLC (Small Cell Lung Carcinoma)

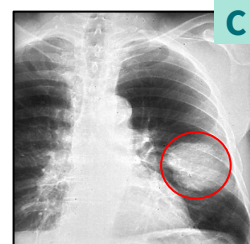
- Chemotherapy
- Radiotherapy



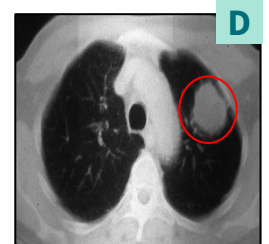
Picture A: very early stage curable adenocarcinoma



Picture B: the patient has opacity which was confirmed by CT



Picture C: 60 years old heavy smoker, with chest pain, Hemoptysis, large tumor was found in the lower zone.
picture D: showed a large mass in the left upper lobe, and after biopsy it turned out to be small cell carcinoma.



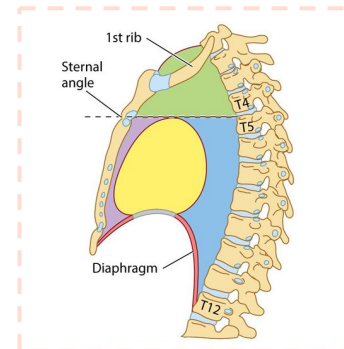
B. Secondary lung carcinoma (metastatic)

<h3>Types</h3>	<ul style="list-style-type: none"> ● Solitary lung nodule: <ul style="list-style-type: none"> ○ Primary lung carcinoma ○ Tuberculous granuloma ○ Mixed tumor ○ Secondary lung carcinoma ○ Miscellaneous e.g. disk pneumonia
<h3>Comparison</h3>	<p>Hamartoma - carcinoid (benign Vs malignant):</p> <ul style="list-style-type: none"> ● Age ● Sex ● X-Ray <ul style="list-style-type: none"> ○ Size ○ Time ○ Calcification <div data-bbox="1114 571 1455 766" data-label="Image"> </div> <p data-bbox="1066 779 1485 851">Picture A: Hamartoma, benign tumor with calcification</p>

Mediastinum Anatomy:

Boundaries

The space in the thoracic cavity between the lungs, it's divided into superior and inferior compartments by the thoracic plane at the level of the sternal angle, and the intervertebral disc of T4-T5, the inferior space is further divided into: anterior (behind the sternum), middle (around the heart and the major vessels) and posterior (in front the vertebra).

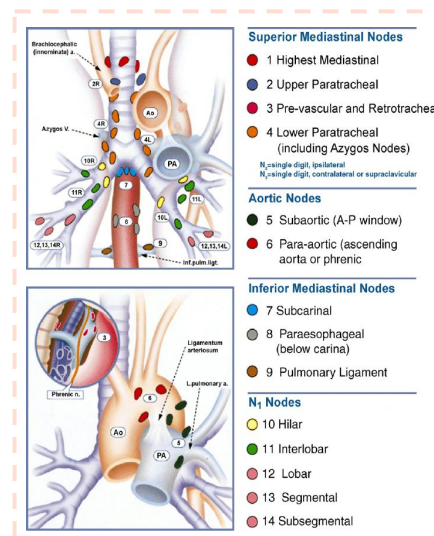


Divisions

- Traditional
- Clinical

Access

- Mediastinoscopy
- Mediastinotomy



- Pulmonary metastasis is a common presentation and may be the only site of metastasis.
- Resection of metastatic lesions may be part of a treatment protocol.
- What is Virchow's node? It is an enlarged left supraclavicular node. It occurs on the left as this is where the cisterna chyli (dilated lymph sac at the end of the thoracic duct) empties into the subclavian vein. Virchow's node is suggestive of metastatic lung or gastrointestinal malignancy.



Mediastinal Mass Lesions

Middle Mediastinum
(Cyst: bronchogenic cyst & pericardial cyst)

Anterior Mediastinum
(5 T's)

Posterior Mediastinum
(Neurogenic tumors, Enterogenous cysts)

Thymus - thymoma

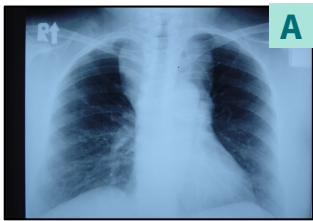
Thyroid - ectopic thyroid masses (goiter)

Teratoma

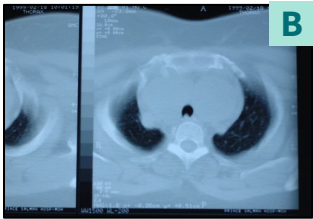
T cell lymphoma

Thoracic aneurysms

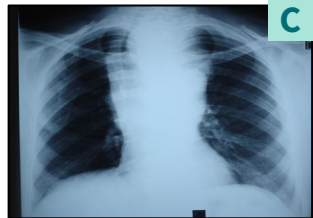
TB lymphadenitis



➤ **Picture A:** large superior mediastinum.



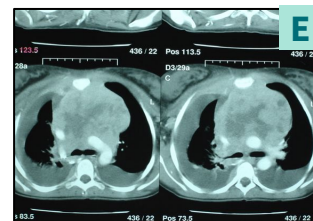
➤ **picture B:** large mass behind the sternum 'retrosternal goitre'.



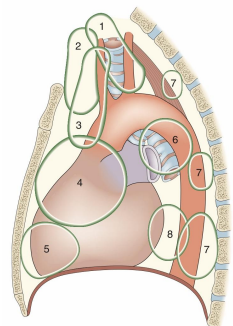
➤ **Picture C:** the trachea is compressed, there is a retrosternal goiter shifting the trachea to the right (away from pathology).



➤ **picture D:** superior and anterior mediastinum enlarged.



➤ **picture E:** there is a large mass in superior and anterior mediastinum compressing SVC → obstruction. The patient has advanced stage lymphoma, the mass is invading the ascending aorta, trachea, carania, and right main bronchus, in addition to pleural effusion.



- 1 Goitre
- 2 Lymph node tumours, primary and metastases
- 3 Thymoma
- 4 Dermoid/teratoma
- 5 Pleuropericardial cyst
- 6 Bronchogenic cyst
- 7 Neurogenic tumour
- 8 Enterogenous cyst

- Benign and malignant masses may arise in the mediastinum. Some clue to the likely diagnosis is provided by the location of the lesion within the mediastinum. Where the diagnosis is in doubt, tissue may be obtained by CT-guided needle biopsy. If this is either not feasible or is unsuccessful, a surgical biopsy can be obtained using mediastinotomy, mediastinoscopy or videothoracoscopy. Patients may be asymptomatic or having vague symptoms. Surgical resection is generally undertaken via a median sternotomy for anterior lesions or a thoracotomy for mid and posterior lesions.

Thymoma



Epidemiology

- The commonest tumor of anterior mediastinum
- Peak 40-60y
- M:F (1:1)



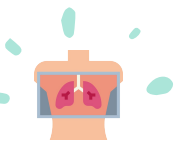
Clinical Feature

- Asymptomatic
- Symptomatic:
 - Mass effect.
 - Systemic effect: **Myasthenia gravis** is the commonest 40-50%.



Pathology

- Classification:
 - Epithelial
 - Lymphocytic
 - Lymphoepithelial
 - Spindle cell
- Benign vs. malignant
- Stages:
 - I, II, III, IV



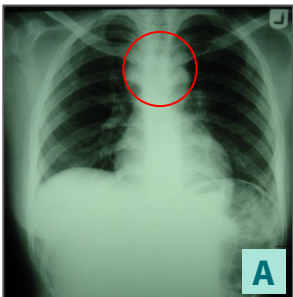
Investigation

- CXR / CT / Biopsy
- Selected cases:
 - Bronchoscopy
 - Esophagoscopy
 - Angiogram

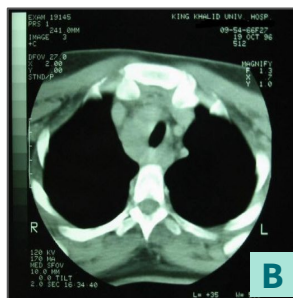


Treatment

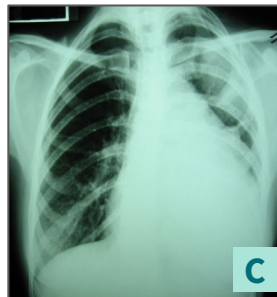
- Benign: complete excision
- Malignant: complete excision if possible
 - If non-resectable or incomplete resection:
 - Post-op radiotherapy.



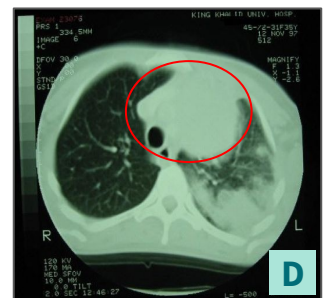
Picture A: superior mediastinal mass.



picture B CT of big mediastinal mass of thymoma.

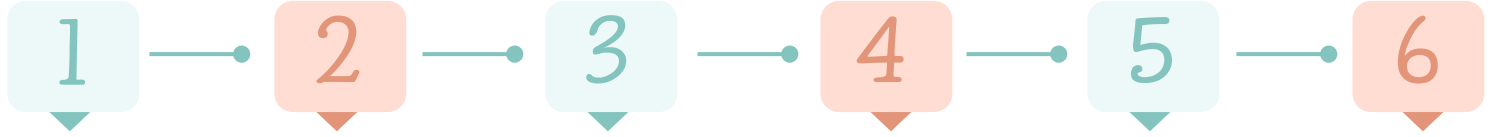


Picture C Advanced case of thymoma extended to lungs and pleura (has to be removed along with the lung and metastasis).



picture D Big mass of thymus (anterior mediastinal thymoma) and Left lung is full of metastasis. stage IV.

Trauma:



1
Road Traffic
Accidents

2
Fractured ribs:
- Simple
- Complicated

3
Haemothorax

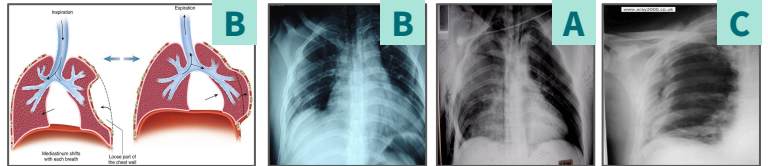
4
Pneumothorax

5
Flail Chest

6
Lung
Contusion &
ARDS

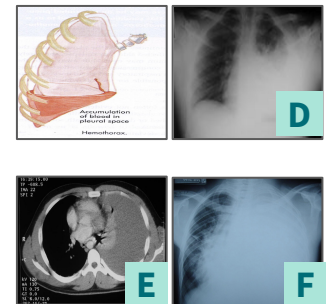
Fractured ribs & Flail Chest

- **Picture A:** a patient of multiple fractures showing hemothorax opacity, lung contusion¹ and surgical emphysema.
- **Picture B:** Flail chest (fracture in two or more consecutive ribs, causing paradoxical movement of that region of the chest).
- In **Picture C:** multiple fractures.



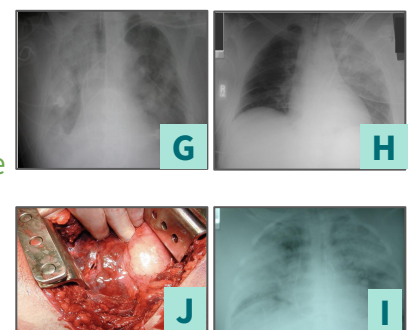
Hemothorax

- Hemothorax: accumulation of blood in pleural cavity
- **Picture D:** Hemothorax which is usually a complication of trauma, gunshot, and one of the causes of pulmonary opacity.
- **Picture E:** Collapsed left lung showing opacity due to hemothorax.
- **Picture F:** Massive hemothorax compressing the trachea and carina pushing them to the other side.



Lung contusion & ARDS

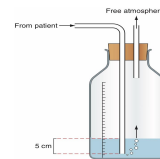
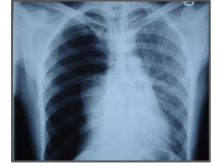
- **Picture G - H:** X ray showing lung contusion (bleeding within the lungs)
- **Picture I:** Advanced lung contusion opacity usually develops after 2-3 hrs
- **Picture J:** Primary treatment of lung contusion is supportive including intubation, ventilation and antibiotics (unless there was an indication like hemorrhagic shock, then we treat it surgically to stop the hemorrhage).
- **Acute respiratory distress syndrome (ARDS)**² is characterized by impaired oxygenation, diffuse lung opacification on chest X-ray and an increasing 'stiffness' of the lungs (decreased compliance).



1. Lung contusion or a bruised lung, often occurs after a blow to the chest. The blunt impact can damage blood vessels, causing blood and fluid to build up in your lungs.
2. Basically it occurs when fluid builds up in the lung. The fluid keeps your lungs from filling with enough air, which means less oxygen reaches your bloodstream.

Pneumothorax

- **Picture A:** Collapsed lung appears radiolucent in X-ray.
- **Picture B:** Both lungs are collapsed with shifted mediastinum
- **Causes:**
 - 40-50 year-old smoker causing secondary pneumothorax.
 - Spontaneous pneumothorax
 - cyst or bullae
- **Treatment:** by inserting a large-bore needle or chest tube (tube thoracostomy) between the ribs to remove the excess air.
- **Pneumothorax** occurs when air enters the potential space between the visceral and parietal pleura.
- **Initial management:** aspiration or by insertion of a chest drain connected to an underwater seal into the pleural space. This allows the lung to re-expand.



Types of Pneumothorax:

Traumatic Pneumothorax

Caused by either:

- **External chest wound:** resulting in open pneumothorax that's often associated with a 'sucking wound', where air moves in and out of a chest wound with respiration.
- **Internal air leak:** spontaneous leakage from a large bulla or small air sac on the lung surface.

Spontaneous pneumothorax

Primary or Secondary:

- **Primary pneumothorax:** typically occurs in young (15–35 years) individuals with essentially normal lungs apart from a few apical bullae or blebs.
- **Secondary pneumothorax:** develops in elderly patients (55–75 years) with a background of emphysema and chronic obstructive pulmonary disease.

Tension pneumothorax:

Pathogenesis:

- The pulmonary leak point may have a flap valve mechanism that allows air out of but not back into the lung, causing a rapid build-up of pressure within the pleural cavity.
- This can be fatal, as the high intrapleural pressure completely flattens the ipsilateral lung while deviating the mediastinum to the opposite side, impeding venous return.



Management:

Spontaneous pneumothorax:

- **Primary spontaneous pneumothorax:**
 - If small and patient is asymptomatic:
 - Observation (should resolve spontaneously in 10 days) reassess with CXR.
 - Small chest tube may benefit some patients.
 - If larger and/or patient is symptomatic:
 - Administration of supplemental oxygen
 - Chest tube insertion to allow air to be released.
- **Secondary spontaneous pneumothorax:**
 - Chest tube drainage



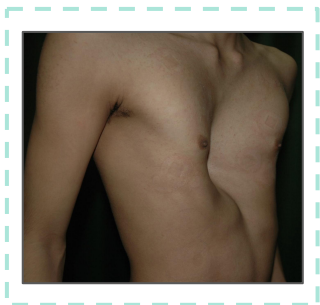
Tension pneumothorax (Medical emergency!):

- If tension isn't relieved by decompression (via large-bore needle or chest tube) followed by thoracostomy the patient is likely to die from hemodynamic compromise.

Open pneumothorax:

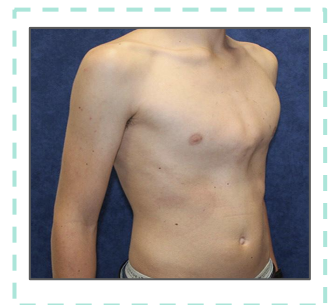
- Immediate treatment with an occlusive dressing taped on three sides to allow air out of the chest but not in.
- Definitive treatment is with a chest drain.

Chest wall deformities:

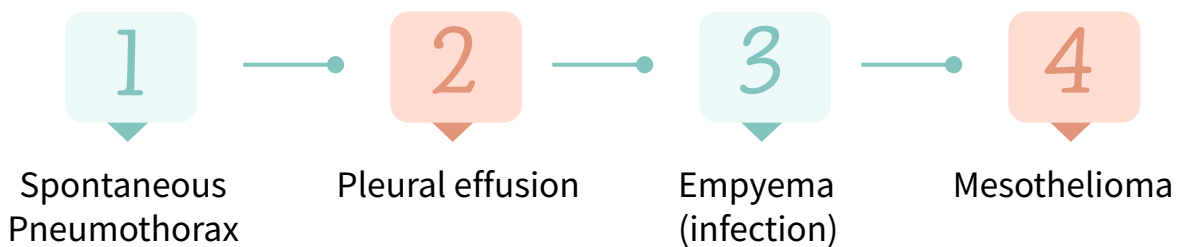



Pectus excavatum¹
(funnel chest)


Pectus carinatum
(pigeon chest)



Pleural Cavity:



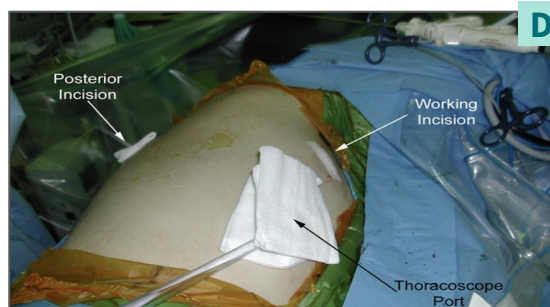
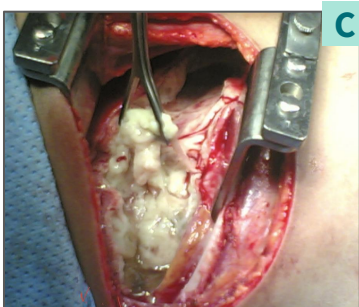
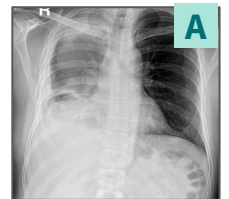
1. Pectus excavatum can affect the heart and respiratory system, it's congenital and we have to rule out congenital cardiac anomalies.
 - Pectus excavatum can be associated with connective tissue disorders such as Marfan's syndrome, and with unilateral breast hypoplasia. Correction is only indicated when the patient's quality of life is clearly impaired because of appearance, & it involves major surgery.

Mesothelioma

- Mesothelioma is a malignancy that involves mesothelial cells that normally line the body cavities, including the pleura.
- **Asbestos** is the principal carcinogen implicated in the pathogenesis of malignant pleural mesothelioma.
- The patient commonly presents with: shortness of breath.
- In many cases, the diagnosis is made by a percutaneous pleural biopsy but, if this is not successful, thoracoscopy or open pleural biopsy is useful.
- The main differential diagnosis is disseminated adenocarcinoma involving the pleural cavity.
- Surgical resection by excision of the parietal pleura, lung, diaphragm and pericardium (pleuropneumonectomy) is not generally reported to offer a survival benefit, except possibly in very early lesions. Radiotherapy and chemotherapy have no curative value. Therapy is, therefore, usually directed towards controlling symptoms.

Empyema & Pleural Effusion

- Pleural effusion is an abnormal collection of fluid in the pleural space while Empyema is a collection of pus within the pleural cavity and it commonly follows pneumonia due to secondary infection of a reactive parapneumonic effusion.
- Thin empyema may be resolved by intercostal drainage.
- Thick & loculated empyema requires formal surgical drainage.
- Other causes of empyema include postsurgical bronchial or oesophageal suture line leakage, lung abscesses, esophageal rupture or perforation, repeated aspiration of pleural effusion, secondary infection of a clotted haemothorax and, rarely, a sub-phrenic abscess.
- **Picture A:** Parapneumonic effusion and collapsed lung (opacity).
- **Picture B:** Collapsed right lung with empyema failed drainage of pus due to thickened pleura (visceral and parietal) and thickened debris.



Picture C-D: Decortication → removing visceral/parietal pleura and debris.

Inserting chest tubes to inflate the lungs and we leave them for few more days until the lungs fill the cavity and return to its normal state.

History and Physical Examination:

Added from Johns Hopkins Textbook of Cardiothoracic Surgery & Talley

History

- History of a potential thoracic surgical patient should include presenting symptoms, previous diagnosis of cardio pulmonary disease, comorbid conditions such as diabetes mellitus, renal and liver dysfunction, current medications and allergies, tobacco use, and alcohol use. As the most frequent complications are pulmonary and cardiovascular, the history should focus on these areas.

- **Major presenting symptoms:**

- Cough
- Sputum
- Haemoptysis

01



02

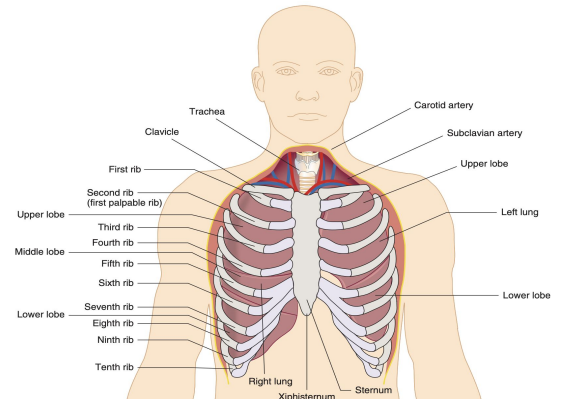
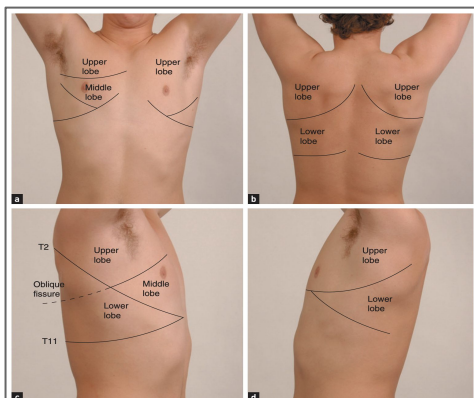
- Dyspnoea (acute, progressive or paroxysmal)
- Wheeze
- Chest pain

03

- Fever
- Hoarseness
- Night sweats

Physical Examination

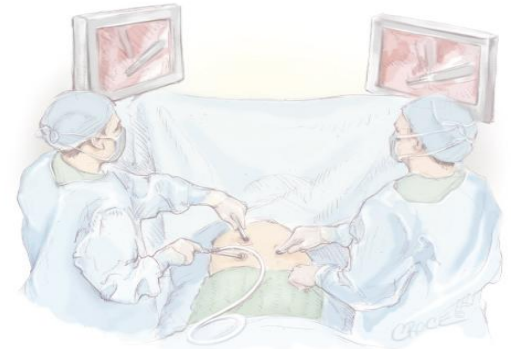
- Examination begins with an assessment of overall appearance, looking especially for evidence of cachexia and generalized wasting.
- Cervical and supraclavicular lymphadenopathy can indicate metastatic disease.
- Cardiovascular examination should note murmurs (valvular disease), arrhythmias (atrial fibrillation), and presence of peripheral edema (congestive heart failure).
- Pulmonary examination should note respiratory rate, use of accessory respiratory muscles, and presence of wheezing or rales.
- Abdominal examination can confirm the presence of regional tenderness, organomegaly, masses, or adenopathy.
- The extremities should be examined for equality of pulses, cyanosis, or clubbing.
- Neurologic examination should focus on motor strength and gait, both of which are important because deficits can affect postoperative mobilization and rehabilitation.



Assessment of Pulmonary Resection:

Assessment addresses two questions:

- Is the patient fit for pulmonary resection?
- Is the disease potentially curable?

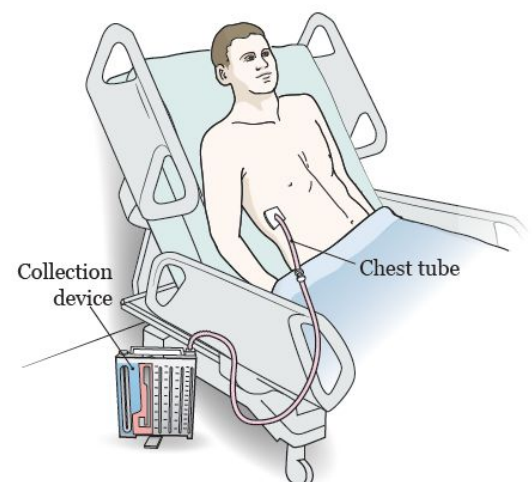


So, patients with poor LV function and/ or unstable angina are not suitable for pulmonary resection. If an effusion is present, this should be aspirated; if malignant cells are noted on cytology, this would preclude resection. Following assessment and surgical resection, the final pathological Tumour, Node, Metastasis (TNM) stage is helpful in indicating prognosis and determining whether a patient might benefit from adjuvant therapy, usually within the setting of a trial.

Chest tube indications:

Added from Kaplan for Surgery, 2020 edition

- The presence of symmetrical breath sounds indicate satisfactory ventilation; an absence or decrease of breath sounds may indicate a pneumothorax and/or hemothorax and necessitate chest tube placement. Pulse oximetry can be used to determine if oxygenation is satisfactory (O₂ saturation >90–95%); hypoxia may be secondary to airway compromise, pulmonary contusion, or neurological injury impairing respiratory drive and necessitate intubation. Measurement of end tidal CO₂ (capnography) is also very useful.



Summary

Recall

Q1: What's pulmonary sequestration? What's the treatment of each type?

Answer: Abnormal benign lung tissue with separate blood supply that DOES NOT communicate with the normal tracheobronchial airway; have systemic arterial blood supply (usually off thoracic aorta).

Treatment → Extralobar? Surgical resection. Intralobar? Lobectomy.

Q2: What is the major risk during operation for sequestration?

Answer: Anomalous blood supply from below the diaphragm (can be cut and retracted into the abdomen and result in exsanguination!); always document blood supply by A-gram or U/S with Doppler flow.

Q3: What's Pectus Excavatum?

Answer: Chest wall deformity with sternum caving inward (Think: exCAVatum = CAVE).

Q4: What's Pectus Carinatum?

Answer: Chest wall deformity with sternum outward (pectus = chest, carinatum = pigeon); much less common than pectus excavatum.

Q5: What are the two types of pleural effusions and their etiologies?

Answer:

1. Transudative → congestive heart failure, nephrotic syndrome, and cirrhosis.
2. Exudative → infection, malignancy, trauma, and pancreatitis.

Q6: What are Light's criteria, whereby if at least one of the criteria is met, the fluid is defined as exudative?

Answer:

1. Pleural fluid-to-serum protein ratio >0.5
2. Pleural fluid-to-serum LDH ratio >0.6
3. Pleural fluid LDH $>2/3$ upper limit of laboratory's normal serum LDH

Q7: What is the diagnostic test of choice? And what is the treatment?

Diagnosis: Thoracentesis (needle drainage) with pleural fluid studies, including cytology.

Treatment:

1. Pigtail catheter or thoracostomy (chest tube)
2. Treat underlying condition
3. Consider sclerosis if malignant pleural effusion

Q8: What is an empyema?

Answer: Infected pleural effusion; must be drained, usually with chest tube(s). Decortication (thoracotomy and removal of an infected fibrous rind from around the lung) may be necessary if tube thoracostomy drainage is incomplete

Q9: What type of lung cancer arises in nonsmokers?

Answer: Adenocarcinoma.

Q10: Cancer arises more often in which lung?

Answer: Right $>$ left; upper lobes $>$ lower lobes.

Q11: What are the signs/symptoms of lung cancer?

Answer: Change in a chronic cough. Hemoptysis, chest pain, dyspnea. Pleural effusion (suggests chest wall involvement). Hoarseness (recurrent laryngeal nerve involvement). Superior vena cava syndrome. Diaphragmatic paralysis (phrenic nerve involvement). Symptoms of metastasis/paraneoplastic syndrome. Finger clubbing.

Q12: What are paraneoplastic syndromes?

Answer: Syndromes that are associated with tumors but may affect distant parts of the body; they may be caused by hormones released from endocrinologically active tumors or may be of uncertain etiology.

Q13: What is the characteristic appearance of hamartoma on CXR?

Answer: "Popcorn" calcification.

Q14: What are the signs/symptoms of lung abscess? What is the associated diagnostic study?

Answer: Symptoms → Fever, productive cough, sepsis, fatigue. Diagnosis → CXR: air-fluid level.

Q15: Where are Thymoma found in the mediastinum? What percentage of patients with thymoma have myasthenia gravis?

Answer: Anterior. 30% to 45%.

Q16: Where in the mediastinum do Neurogenic Tumors occur?

Answer: Posterior, in the paravertebral gutters

Quiz

MCQ

Q1: A 42-year-old homeless man presents with a 3-week history of shortness of breath, fevers, and pleuritic chest pain. Chest x-ray (CXR) reveals a large left pleural effusion. Thoracentesis reveals thick, purulent-appearing fluid, which is found to have glucose less than 40 mg/dL and a pH of 6.5. A chest tube is placed, but the pleural effusion persists. Which of the following is the most appropriate management of this patient?

- A) Placement of a second chest tube at the bedside and antibiotic therapy.
- B) Thoracotomy with instillation of antibiotics into the pleural space.
- C) Thoracotomy with decortication and antibiotic therapy.

Q2: A 63-year-old woman with chronic obstructive pulmonary disease (COPD) presents with a several-week history of fever, night sweats, weight loss, and cough. Her CXR is noted to have a density in the left upper lobe with a relatively thin-walled cavity. Bronchoscopy and computed tomographic (CT) scan are suggestive of a lung abscess rather than a malignant process. Which of the following is the most appropriate initial management of this patient?

- A) Systemic antibiotics directed against the causative agent.
- B) Left upper lobectomy.
- C) Surgical drainage of the abscess.

Q3: A 71-year-old woman with a 40-year smoking history is noted to have a peripheral nodule in her left upper lobe on chest x-ray. Workup is consistent with small cell lung cancer with ipsilateral mediastinal lymph node involvement but no extrathoracic disease. What is the best treatment option for this patient?

- A) Thoracotomy with left upper lobectomy and mediastinal lymph node dissection
- B) Neoadjuvant chemoradiation followed by thoracotomy with left upper lobectomy.
- C) Chemoradiation.

Q4: A previously healthy 20-year-old man is admitted to the hospital with acute onset of left-sided chest pain. Electrocardiographic findings are normal, but CXR shows a 40% left pneumothorax. Appropriate treatment consists of which of the following procedures?

- A) Thoracotomy
- B) Tube thoracostomy
- C) Thoracostomy and intubation

★ **Q5:** A 32-year-old male presented with history of mild chest pain, productive cough especially early in the morning and dyspnea for 6 weeks. He gave history of swallowing a metal object. Chest CT-scan showed cystic abnormality. What is the most likely diagnosis?

- A) Bronchiectasis
- B) Thymoma
- C) Pneumonia

Q6: A 72-year-old woman is brought to the emergency department because of lethargy and weakness for the past 5 days. During this period, she has had a headache that worsens when she leans forward or lies down. Her arms and face have appeared swollen over the past 2 weeks. She has smoked two packs of cigarettes daily for 40 years. Examination shows jugular venous distention. There is pitting edema in both arms. Which of the following is the most likely cause of this patient's symptoms?

- A) Pulmonary embolism
- B) Pulmonary tuberculosis
- C) Lung cancer

★ **Q7:** In SCLC, which one of the following is used for staging?

- A) Lung aspiration
- B) Bronchoscopy
- C) CT

★ **Q8:** What is the GOLDEN STANDARD method to investigate primary lung carcinoma?

- A) Chest X-ray
- B) CT scan with IV contrast
- C) Bronchoscopy

★ **Q9:** Which one of the following statements are correct regarding SCLC management?

- A) No surgical indication to do any intervention
- B) Surgery only
- C) Chemotherapy to down stage the tumor and then the patient undergo surgery

Q1	C	Q4	B	Q7	C
Q2	A	Q5	A	Q8	B
Q3	C	Q6	C	Q9	A

Answers

Extra Questions

Good Luck!



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Note taker



Reviewer

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